THE APPLICATION OF BRILLOUIN SCATTERING

TO FLOW FIELD DIAGNOSTICS

PROGRESS REPORT

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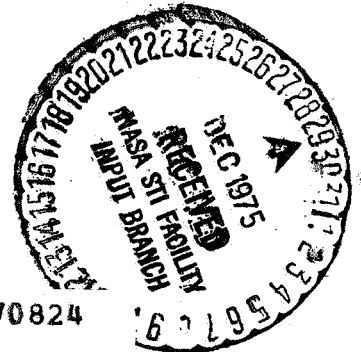
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As indicated in the proposal, the basic aim is the investigation of the possibility of obtaining nonintrusively data bearing on the fluctuations in density or related variables on a flow field of monoatomic species, in this case, He.

It is well-known that the technique most suitable for the determination of pointwise density to specie concentration, non-intrusively is the Raman scattering technique. This technique, while not a universal cure-all in flow field diagnostics, is a very powerful measurement technique for multiatomic species. It fails in the case of monoatomic species for obvious reasons. The work in progress concerning Brillouin scattering is an attempt to develop a technique which could help to acquire experimental data nonintrusively in a flow field consisting of monoatomic species and still be spectrally distinguishable from normal Rayleigh scattering, which cannot be separated from Mie scattering.

Since the inception of this investigation, the work is proceeding as outlined in the proposal.

In the first place, a static chamber has been designed and constructed. This chamber is essentially a modified part of a previously used system. It is capable of being evacuated and

pressurized. It has a number of optical access ports. These will permit evaluation of the angular dependence of the Brillouin scattering of a fluctuating turbulent medium, as distinguishable from a quiescent homogeneous medium. This chamber will serve essentially as part of a calibration system for the optics and instrumentation to be developed for the Brillouin diagnostic system. In addition, a test stand has been built on which the necessary instrumentation can be mounted. This is seen in Fig. 1. Since the main optical instrument to be used is a confocal Fabry-Perrot interferometer, and the one available in our laboratory, the Jodon SA-7500 Model, has a useful entrance and exit aperture of only 8mm diameter, an attempt was made to construct a Fabry-Perrot interferometer of our own design, having a useful entrance and exit aperture of 25mm. This could conceivably provide a sensitivity of an order of magnitude higher. As of this moment we are experiencing some difficulties with our Fabry-Perrot spectrum analyzer. These difficulties have been traced to a machine thread which turned out to be not precise enough. We hope to be able, in due course, to overcome this problem. In the meantime, the commercial Jodon SA-7500 is being utilized. A schematic diagram of the total system is shown in Fig. 2. This system is being completed at the moment, as seen in Fig. 1, which is an overall photographic view of the test apparatus. Barring any last minute

difficulties, it is believed that by the middle of January 1976 some initial test will be conducted.
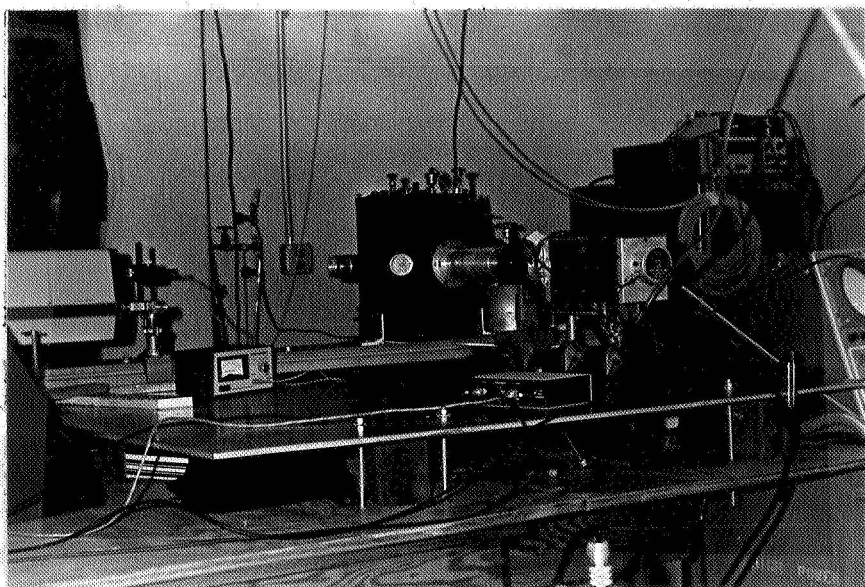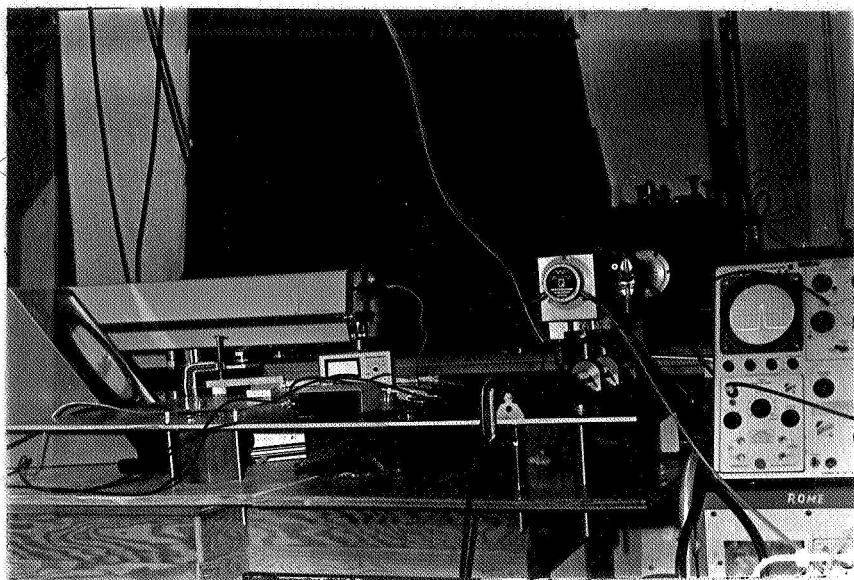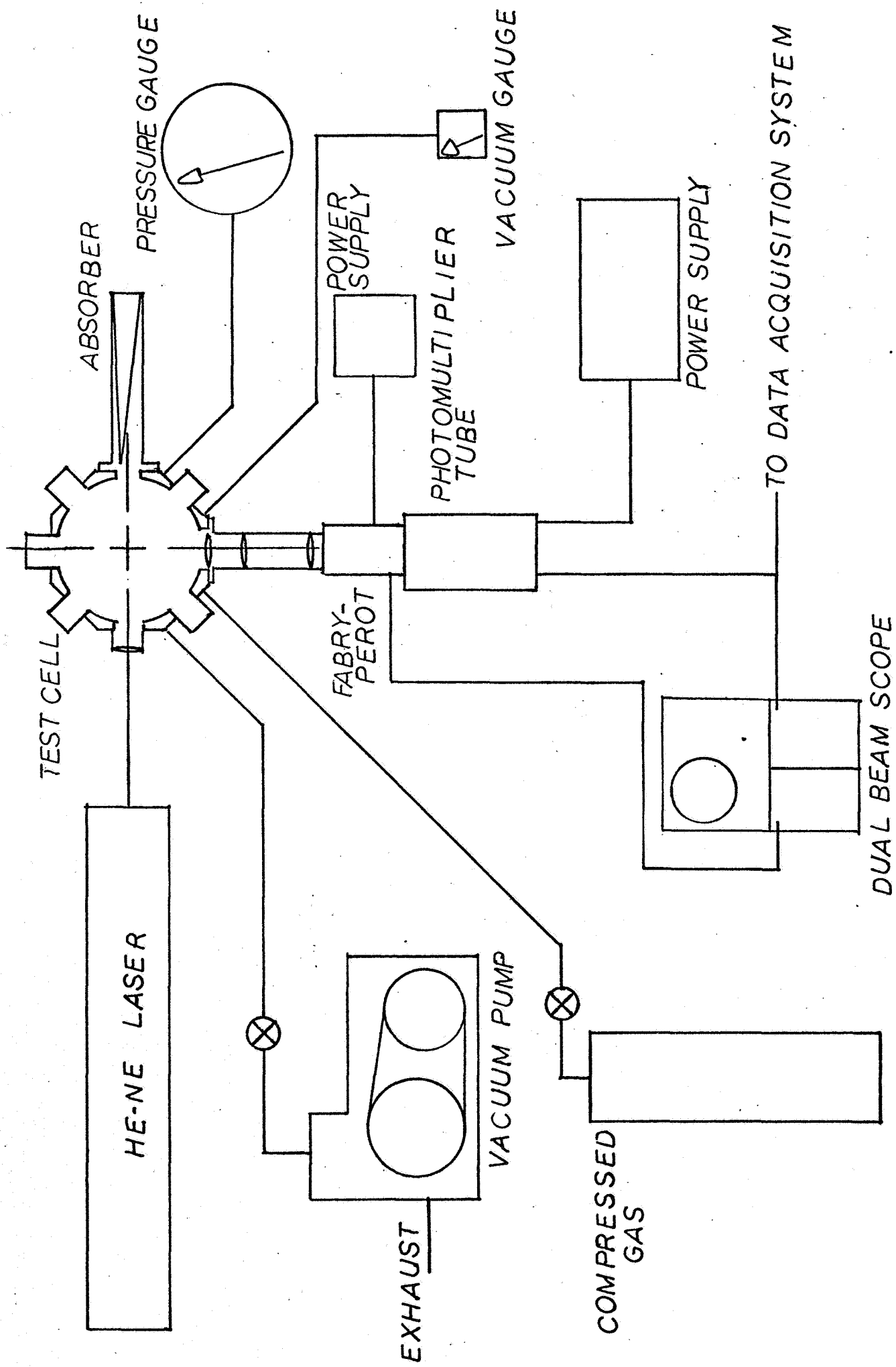
FIG.I PHOTOGRAPHS OF THE EXPERIMENTAL APPARATUS

FIG. 2 SCHEMATIC OF THE EXPERIMENTAL APPARATUS